Thysanoptera of Kauai with Notes on the Incidence of Yellow Spot on Wild Host Plants[1]

BY K. SAKIMURA[2]
Pineapple Experiment Station
Honolulu, Hawaii

(Presented at the meeting of December 3, 1937)

A collection of thrips on Kauai and a survey of the incidence of yellow spot virus (of which *Thrips tabaci* Lind. is the vector) on wild host plants made in June 1937.

THRIPS COLLECTION

The writer had previously examined very few specimens of thrips from Kauai (4) and information on thrips of this island is meager. Sixteen species were collected on this trip, 3 of which have been previously recorded; the remainder were hitherto unrecorded on Kauai, or new species (Table 1).

Heliothrips rubrocinctus was common and widely distributed. *Chirothrips sacchari,* an endemic species in the Hawaiian Islands, was incidental on Kauai. Another endemic species, *Scirtothrips antennatus,* was quite common on panax as on Oahu. Burdock was the only plant other than panax from which this was collected, but it may have been an accidental host. *Anaphothrips swezeyi* was found commonly feeding on grasses on Kauai. The occurrence of *Taeniothrips alliorum* has previously been recorded and it is now found very widely distributed and present though never in large numbers, wherever onions are planted. *Taeniothrips hawaiiensis* was one of the most common species, as on the other islands, distributed widely and feeding on many varieties of flowers. Many additional new hosts were found. Examination of gladiolus flowers for the possible presence of *Taeniothrips simplex* always showed the presence of *Taeniothrips hawaiiensis. Taeniothrips simplex* has been recorded from Oahu, Maui and Hawaii but it appeared to be absent on Kauai. *Thrips abdominalis,* a widely distributed species, was also found on Kauai, where it was subincidental. *Thrips nigropilosus,* another widely distributed species, was found infesting plantago heavily at 3,000 to 3,500 feet above sea level along the Waimea Canyon road. The finding of this species in the Hawaiian Islands is very recent and the known distribution is limited to Honolulu, Oahu, and Mt. Haleakala, Maui (6,000 feet above sea level). The addition of the present record, indicating wide distribu-

[1] Published with the approval of the Director as Technical Paper No. 113 of the Pineapple Experiment Station, University of Hawaii.

[2] This investigation was conducted under the direction of Dr. Walter Carter, Entomologist.

tion and establishment in the wilderness at very high altitudes is suggestive of earlier invasion of Hawaii than has been supposed. The brachypterous form was first collected in the Hawaiian Islands. The macropterous form was also present but was collected from separate spots and the brachypterous form was predominating in number. *Thrips panicus,* a common grass feeder, was also present on Kauai. *Thrips tabaci* was found to be one of the most common species, distributed widely from wet Haena to dry Mana and from the seashore to the top of Waimea Canyon. Six new host plants were found for this polyphagous thrips. Onions were heavily infested everywhere, and a moderate population was also found on *Emilia* which was densely distributed throughout the cultivated lowlands. The abundance of other weed hosts was also observed. The relationship between the *Thrips tabaci* and the yellow spot virus incidence is discussed in another part of the paper. Three new species of *Isoneurothrips,* which will be described later, were collected from wild hosts, all at non-cultivated high altitudes. Fourteen species of the genus *Isoneurothrips* have been recorded from Formosa, Siam, Sarawak, Java, Australia, Marquesas, and the Hawaiian Islands. Six of these are from the Hawaiian Islands and now 3 other species are added. A good-sized colony of *Microthrips piercei,* an uncommon species, was found on carrots, the first record on a crop plant. This species had previously been collected only from cocklebur and another minor plant. Subsequently, in a truck garden on Oahu, lettuce, chard, beet, eggplant and radish were very recently found uniformly infested with a minor population and without noticeable feeding injury upon these crop plants. *Haplothrips gowdeyi* was also found to be one of the most common widely distributed species feeding upon various hosts. Ten new host plants were added to the previously recorded 55 plants. *Haplothrips melaleuca,* a predacious species, was also distributed on Kauai, where it was subincidental as on the other islands.

INCIDENCE OF YELLOW SPOT VIRUS ON WILD HOST PLANTS

Yellow spot disease of pineapple has been known from the island of Oahu since 1926 and subsequently from the islands of Hawaii, Maui, Lanai and Molokai, but it was not recorded from the island of Kauai until 1935.[3] The disease has since appeared in the Koloa-Kalaheo-Hanapepe district, and was first reported in the Anahola-Moloaa district in 1937 (fig. 1). The general sources of infection for pineapple plants are not the infield infected pineapple plants. However, the outfield infected *Emilia,* which is the major wild host plant of the virus due to its abundance, high susceptibility and vector's preference, serves as sources of dispersal

[3] Includes the unpublished data collected by the various members of the station. Dr. M. B. Linford first surveyed the island of Kauai for yellow spot in 1935.

of the vector (1, 2). Search for such sources of infection in both districts was undertaken and the data are briefly summarized here.

Four different species of *Emilia,* which are all introduced species, were found on Kauai, namely: *Emilia sonchifolia* DC.[4] (red flower, common species), *Emilia No. 3* (3) (purple flower), *Emilia No. 4*[5] (purple flower, with creeping and perennial growth), and *Emilia coccinea* (Sims) Sweet (orange flower, incidental species). Some of these *Emilia* were found more or less restricted to certain plant associations which served as separate geographical and epidemiological reservoirs for the virus.

Emilia sonchifolia. The habitats of this species were found restricted to sparse secondary wild growth, i.e., roadsides, city lots, ditch banks, eroded hillsides, fallow land, recently abandoned fields, sugar and pineapple fields, and other cultivated land. These were not found among dense wild growth, i.e., forest areas, densely covered hillsides and gulches, grassy grazing and waste land, sand beaches and rocky shores.

Emilia sonchifolia was found commonly in the dry districts of Kauai, especially in the Lihue-Koloa-Kalaheo-Hanapepe district. However, it was not observed in the Makaweli-Mana district, but few were found at high altitudes along the Waimea Canyon road. In the wet districts it was very rare, and incidental plants were found scattered in the Wailua-Hanalei district. *Emilia sonchifolia* was abundant in and around pineapple fields of the Koloa-Kalaheo-Hanapepe district. The thrips population on it was moderate, and a high percentage of *Emilia* was infected by yellow spot. The disease on pineapple plants, ranging from minor to moderate in severeness, has been known to be present for some time and the incidence of virus on wild host plants has been well established throughout the district. It is presumed that all of the infected *Emilia* within the area were serving as the prevailing sources of infection for pineapple plants. The thrips population on *Emilia sonchifolia* outside of this district was small, and disease infection was not found west of Hanapepe nor east or north of Halfway Bridge (between Lihue and Koloa).

In the Koloa-Kalaheo-Hanapepe district, *Emilia No. 3* and *No. 4* were distributed west of Nawiliwili as far as Hanapepe but majorly along the shore line and away from the plant association of *Emilia sonchifolia,* and there were not infected with yellow spot virus. According to the observations of Dr. Linford (unpublished data), these *Emilia No. 3* and *No. 4* were found in 1935 mixed with *Emilia sonchifolia* in pineapple fields and surrounding abandoned areas of the Koloa-Kalaheo district and were found there infected with yellow spot virus.

[4] *Emilia sagittata* (Vahl) DC. which has been used for the Hawaiian species is a misdetermination (3).

[5] Determined by Mr. E. Y. Hosaka of the Bishop Museum.

Emilia No. 3 and No. 4. Favorable habitats of *Emilia No. 3* and *Emilia No. 4* were found essentially similar, but entirely different from those of *Emilia sonchifolia.* These were narrow zones along the seashore passing through the open shore hillsides, beach roadsides, waste land, grazing land, sand dunes and rocky beaches. However, shady forests, dense growth of tall lantana or grass in gulches, cultivated land and other sparse secondary wild growth were not their preferred habitats. Among the above-mentioned habitats, these two species of *Emilia* were found usually dominating the association (unless disturbed by grazing or other factors) in open areas of dense short grass sod (commonly of carpet grass).

Emilia No. 3 was found distributed from Wainiha to Hanapepe along the shore line (33 stations were checked). It was not found along the shore from Hanapepe to Mana where it was dry and the vegetation was highly disturbed, and along the shore of Haena where the forest approaches it directly. Incidental stands were found inland sometimes. In the vast waste land located between the seashore and cultivated area of the Kapaa-Anahola-Moloaa district, a very thick growth of this *Emilia*—highly dominating the association—was found.

Emilia No. 4 was found associated with the dominating *Emilia No. 3* throughout its distribution and was most abundant simultaneously in the Kapaa-Anahola-Moloaa district.

The thrips population on *Emilia No. 3* and *No. 4* ranged from none to moderate. No infestation was found on plants with leathery leaves growing near windy and dry shores. The highest population was present near Anahola gulch. In spite of the 50 miles' distribution of these *Emilia,* the infection with yellow spot was locally restricted to about 15 miles. The highest concentration of the disease (ranging from 25 per cent to 100 per cent with different samples) was found near Anahola gulch where the highest populations of *Emilia* and thrips were simultaneously present. The disease infection gradually decreased toward Moloaa and the Lihue Airport. Other isolated infections of very minor percentage of plants were present near the Nawiliwili waterfront. The localized heavy infection near Anahola gulch and its wide expansion suggest that the successful invasion of the virus in this district has not been of this season, but probably after January 1935 when Dr. Linford found no incidence of virus on wild host plants north of Koloa gap (unpublished data).

The pineapple fields in the Anahola-Moloaa district were located on the coastal plateau, and a wide strip of waste land, where a well established and concentrated potential source of infection existed, was sandwiched between the shore and these fields. The prevailing wind blows from the sea toward the pineapple fields through the waste land. *Thrips tabaci,* the vector of yellow spot, has been known not to migrate readily but would disperse when its food supply is

disturbed by drying, grazing, weeding, or other purely biological causes (1). Such a dispersal seemed to have happened in the present case which caused the sudden and first appearance of the disease on pineapple plants (moderate in severeness), in spite of the preceding outfield establishment of the virus. Another probable factor would be a sudden increase of the vector population occurring under the prevailing ecological conditions. A higher infection of pineapple plants was found along the margin of the fields adjacent to the waste land. In this district the population of *Emilia sonchifolia* was very small and the pineapple fields were practically free from it. The incidence of virus on inland *Emilia sonchifolia* was not observed and it is therefore concluded that it did not form an additional source of infection.

In the Lihue Airport-Kealia district, *Emilia No. 3* and *No. 4* were infected, but pineapple plants were not present except a few at the Kapaa Homestead, far distant from the coast. In the Hanalei

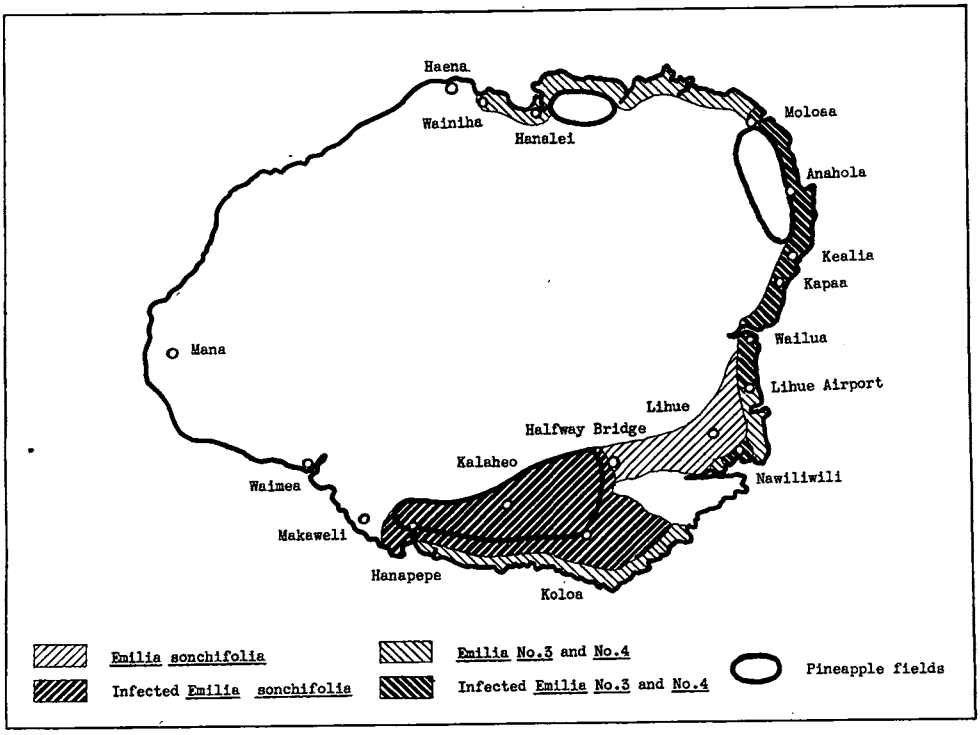

Figure 1. Sketch map of the island of Kauai showing geographical distribution of *Emilia* and incidence of the yellow spot virus in the *Emilia* population, as observed in June, 1937.

district pineapple plants were free from disease associated with an absence of infected *Emilia*.

Concerning the probable introduction of yellow spot virus into the Anahola-Moloaa district from the Koloa-Kalaheo-Hanapepe district, details have not been known beyond mere possible surmising.

SUMMARY

Sixteen species of thrips were collected from Kauai; of which 13 are hitherto unrecorded on that island, or new species. Faunal characteristics are not different from those of the other islands of the Hawaiian group.

In one locality the sudden appearance of yellow spot of pineapple was preceded by a firm establishment of the virus on nearby wild host plants, *Emilia No. 3* and *Emilia No. 4* serving as typical outfield sources of infection.

LITERATURE CITED

1. Carter, Walter. Populations of *Thrips tabaci* Lind. with special reference to virus transmission. (Manuscript)
2. Linford, M. B. 1932: Transmission of the pineapple yellow-spot virus by *Thrips tabaci*. Phytopath. 22(4):301-324.
3. St. John, H., and E. Y. Hosaka. 1932: Weeds of the pineapple fields of the Hawaiian Islands. Univ. Hawaii Res. Bul. 6:1-196.
4. Sakimura, K. 1937: A survey of host ranges of thrips in and around Hawaiian pineapple fields. Proc. Haw. Ent. Soc. 9(3):415-427.

TABLE I. THRIPS COLLECTED AND THEIR HOST PLANTS ON KAUAI

†**Heliothrips rubrocinctus** (Giard)
*Guava
Mango

†**Chirothrips sacchari** Moulton
**Setaria geniculata*

†**Scirtothrips antennatus** Moulton
Panax
*Burdock

†**Anaphothrips swezeyi** Moulton
**Setaria geniculata*
**Tricholaena rosea*

Taeniothrips alliorum Pr.
Onion

†**Taeniothrips hawaiiensis** (Morgan)
**Commelina nudiflora*
**Hemerocallis flava*
*Easter lily
*Gladiolus
**Mirabilis jalapa*
*Hydrangea
Alfalfa
**Acacia koa*
Ipomoea sp.
**Hypochaeris radicata*

†**Thrips abdominalis** Crawford
**Emilia coccinea*

†**Thrips nigropilosus** Uzel (macropterous and brachypterous forms)
**Plantago lanceolata*

†**Thrips panicus** Moulton
**Setaria geniculata*

Thrips tabaci Lind.
Onion
Mirabilis jalapa
*Cabbage
Alfalfa
**Acacia koa*
Carrot
Lantana camara
Solanum nodiflorum
*Tomato
*Tobacco
Emilia sonchifolia
**Emilia coccinea*
**Emilia Nos. 3* and *4*

†**Isoneurothrips** spp.
(Three new species were collected which will be described later)

†**Microthrips piercei** Morgan
*Carrot

Haplothrips gowdeyi (Frank.)
**Setaria geniculata*
**Paspalum orbiculare*
**Commelina nudiflora*
Gladiolus
Onion
Alfalfa
*Carrot
Ipomoea sp.
**Plantago major*
**Plantago lanceolata*
Richardsonia scabra
**Solanum nodiflorum*
**Emilia coccinea*
**Emilia Nos. 3* and *4*
**Hypochaeris radicata*

†**Haplothrips melaleuca** Bag.
**Emilia Nos. 3* and *4*

* New records of host plant in the Hawaiian Islands.
† Hitherto unrecorded species on Kauai.